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Commissioner for Patents

Attached is a copy of an English translation of FR 2 734 709 A1, the reference having been applied in the final Office action of February 18, 2004.

Dave Willse
Primary Examiner
Art Unit: 3738

– attachment: FR2734709 translation

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PTO 04-3381 French Patent No. 2 734 709

TOTAL KNEE PROSTHESIS

Jacques Moulin

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TOTAL KNEE PROSTHESIS

[Prothese totale de genou]

Applicant: Jacques Moulin

The present invention relates to a knee prosthesis whose three principal functions are a shock absorbing system, a large contact surface which reduces the pressure and applies the principal force along the axis of the femur and of the tibia, and a great capacity for replacement in case of accidents or multiple intervention while maintaining mobility and posture as in the natural knee. /1*

To achieve these functions, a certain number of arrangements are provided.

To ensure the absorption of shocks due to walking, waking down stairs … an absorbing material 4 which is sufficiently flexible is sandwiched between the tibial element 2 and an intermediate plate 5, which makes it possible to reduce the load peaks and to reduce the instantaneous force of abrupt shocks and sudden movements by increasing the time of load application. Thus wear and risks of unseating are highly reduced. This shock absorbing element in addition makes it possible to use, without damage, metallic materials or oxides or carbides or

* [Numbers in the right margin indicate pagination of the original text.]

[sic; which are] very hard to reduce friction and particle wear without increasing the stresses and effects of shocks in the bone-prosthesis connections.

To reduce contact pressures, wear, and to prevent condyles and sockets from becoming brittle, the contact surface is large and, above all, it is not limited to a theoretical line of position of extension or hyperextension and within the normal amplitude of walking, in addition, this surface makes it possible to transmit the maximum load in the axis of the femur and in the axis /2 of the tibia without resting on the condyles and sockets, but by a central bearing area where the bones are the most solid, the support surface on the condyles and sockets serving only to ensure the vertical stability, which is already obtained to a large extent by the lateral ligaments. Thus, the collapses of the sockets and condyles which have been observed [in the past], in part associated with pain, are eliminated or at least highly reduced.

To make it possible to solve the very delicate problems of multiple interventions and severe trauma, the prosthesis, which is still based on the same principle but thicker, comprises artificial ligaments which connect in a flexible and replaceable manner the tibial element 2 and the femoral element 1 to reconstruct the lateral ligaments and the oblique and semi-membranous popliteal ligament, and a mechanical device to ensure the automatic rotation of the knee.

Description of the base prosthesis

Plate 1, 2, 3, 4. Figures 1, 2, 3, 4, 5, 6, 7, 8, 9.

A shock absorbing plate 4 is sandwiched between the tibial element 2 and an intermediate plate 5. This plate must not undergo any vertical translation movement with respect to the tibial element 2, and the entire assembly must preserve the free passages of the conservable ligaments and tendons. To achieve this, the three elements tibial element 2, shock absorbing element 4 and intermediate plate 5, have an overall rectangular shape, which remains, in the back half of the profile, with the exception of a notch, in its plane of symmetry to respect the inter-socket space and the insertion of the fibula; in the front half the rectangular shape narrows in the form of two symmetric arcs of circles to "espouse" the shape of the tibia. These different shapes are connected by connection spokes so that they do not present any sharp angles on the prosthesis. /3 These shapes which are theoretically defined can be refined and modified to better "espouse" the shape of the human joint. The tibial element 2 carries, on its upper face, an edge which reflects the contour and has cross section forming a stair case pattern (plate 2. Figures 4 and 5). The shock absorbing element 4 (plate 3. Figures 6 and 7) has a contour such that it is centered in the internal part of the edge of the tibial element and rests on the bottom of the plate of this element. Its thickness is greater than the height of the edge of the tibial element, and its contour is the same over its entire height. Recesses which are parallel to the contour on its two faces, the upper face and the lower face, leave a sufficient space to allow the free deformation of this material and

thus ensure the shock absorption. The intermediate plate 5 (plate 4. Figures 8 and 9) has a contour which is identical to that of the tibial element and it carries on its lower planar face an edge which is complementary to the edge of the tibial element so that this plate cannot turn about a vertical axis with respect to the tibial element, a slight radial tolerance allows the vertical translation of these elements while ensuring a baffle seal to prevent human fluids from circulating around the shock absorbing element, a larger vertical tolerance allows the shock absorption. To prevent the translations of the elements and to limit the rotations about horizontal axes of the elements, tibial element 2 and intermediate plate 5, the tibial element 2 has a blind hole which is perpendicular to the plate, where the shock absorption element 4 has an opening hole of the same diameter and the intermediate plate 5 has a pivot of the same diameter so that these three holes and pivot are aligned and sufficient space remaining between the bottom of the blind hole and the end of the pivot allows the free shock absorption of the prosthesis. The length of engagement between the pivot and the blind hole is such that it prohibits any risk of buckling. /4

Plates 1, 5, 6. Figures 1, 2, 3, 10, 11, 12, 13, 14, 15.

The contact between the tibial element and the rest of the prosthesis must allow a reduced contact pressure to decrease wear and frictional forces, but it must also, and above all, not fragilize the condyles and lateral ligaments. To achieve these performance levels, the principal forces must be applied along the axis of the tibia and the axis of the femur. The shape of the contact will thus be, in a perpendicular cross section, a profile made from two line segments D_1, D_2 which are symmetric with respect to the plane of symmetry of the prosthesis, and connected by a convex or concave arc of a circle A_1 having a constant radius (plate 8. Figures 19, 20, 21), with respect to the femoral element 1; thus the load is primarily received by this arc of a circle in the axis of the tibia and of the femur, and the contact along the line segments allows the stabilization of the alignment of the planes of symmetry of the femoral element, on the one hand, and of the rest of the prosthesis, on the other hand. To respect the physiology of the joint and to allow the correct movements of the latter, this profile of a perpendicular cross section, as defined above, forms, in terms of volume, on the femoral element 1 a spiral of constant height, corresponding to the widths of the condyles having axes perpendicular to the plane of symmetry of the femoral element 1 with three or four winding centers and radii, or a continuous spiral with variable winding center and radius to approximate the anatomical shape as much as possible. In the position of the prosthesis corresponding to the upright position of the patient, in the position of hyperextension and, in general, based on the amplitude of the flexion which characterizes normal walking, the radius of the spiral and the center of curvature are fixed, and the radius of the arc of a circle of the profile of the perpendicular cross section is the same as that used to form a portion of a sphere or a portion of a torus of revolution in this zone. The element 3 opposite /5

this contact possesses a perpendicular cross section which is complementary to the profile of the femoral element 1 and, in terms of volume, a spiral profile having the same winding radius as that in the common contact zone in the standing position or the position of hyperextension; if there is more flexion than typical for the amplitudes during walking, the winding radius of the spiral of the femoral element 1 decreases as one moves toward the posterior part of the femoral element, and thus the contact is transformed into a linear contact. In the standing position or in the position of hyperextension, the contact will be then made along a surface having a sufficient dimension to considerably reduce the contact pressures, the frictional forces and wear. In the flexed position, the contact will be along the line of the profile of the perpendicular cross section, which allows axial rotation and limits contact pressures for these transient positions (limited duration under load). From the axis of the femur and toward the back, the shape of the profile is limited to the width of the condyles to form two curved "tongues" separated by an empty space having a general shape with constant width; in fact the width is slightly variable and asymmetric to respect the physiology of the condyles. The profile continues in the femoral element on its front face by a "helicoidal" spiral, or one closely resembling this purely geometric definition, to approximate the morphology by progressively reducing its width and the length of the arc of the arc [sic] of a circle to receive the contact of the patellar element. All the surfaces of the femoral element, as well as all the elements which are in direct contact with the resected bones, are connected by appropriate spokes so that they do not present any sharp angles on the prosthesis.

Plate 1, 4, 5. Figures 1, 2, 3, 8, 9, 10, 11, 12.

The contact surface on the remainder of the prosthesis, opposite the femoral element, /6
is part of a slide 3 or is directly an integral part of the intermediate plate 5.

In the case of a slide 3 which is put in place to reduce friction in contact with the femoral element 1, this slide 3, whose length is less than that of the intermediate plate 5 in such a manner that it does not overextend toward the front or toward the back of the intermediate plate 5 during a complete flexion-extension movement, possesses, on its lower face, the shape of a prismatic slide formed from two lateral planes, which are symmetric with respect to the plane of symmetry of the prosthesis, and a tenon or a groove with a rectangular perpendicular cross section in its middle. The intermediate plate 5 has a complementary shape in such a manner that contact is made on the two planes and on the flanks of the tenon and of the groove of the slide 3. The choice between tenon or groove (Plate 9. Figures 22 and 23) can be influenced by the choice between convex or concave for the arc of a circle of the friction profile of the femoral element, to reduce the height of the prosthesis and thus the quantity of bone which must be removed on the tibial plate and the condyles.

In the case where the slide 3 does not exist, the shape of the contact with the femoral element 1 of the intermediate plate 5 is the same as the upper shape of the slide 3 described above.

Plate 2, 6. Figures 4, 5, 13, 14, 15.

The tibial element 2 carries a conical pivot on its planar lower face which is accommodated in the medullar cavity of the tibia to ensure its cemented connection on the internal plane and on said pivot. The connection between tibial element 2 and the tibia is thus a complete sealing connection; resting planar on the resected face of the tibial plate, centering along the medullary cavity of the tibia.

The surface on the femur side of the femoral element 1 consists of planes which are /7
perpendicular to the plane of symmetry of the prosthesis forming a profile having a polygonal perpendicular cross section to achieve rigidity of the prosthetic element and a minimum of resection of the femur, a conical pivot is accommodated in the medullar channel of the femur to ensure the complete sealing connection with the femur by polygonal engagement comprising a bearing plane which is normal to the axis of the femur and a pivot connection with the medullary cavity of the femur.

Plate 1, 6, 7. Figures 1, 3, 13, 14, 15, 16, 17, 18.

A patellar element 6 carries on its external face (prosthesis side) a shape which is a portion of a convex or concave torus depending on the shape of the femoral element 1 having the same winding radius and profile as those of femoral element 1 in the part in contact with the slide in the standing position, so that the shapes of the femoral elements of the patellar element 6 are perfectly complementary in a position of flexion and axial rotation. On its internal face (patellar side) the common contact surface between the patella and this element consists of a plane which is parallel to the middle plane of the condyle-associated and external surfaces of the patella, completed by two lateral small tongues having a prismatic cross section to ensure a complete sealing connection with a patella by planar and bilateral rectilinear support so as not to reduce the rigidity of the patella when exposed to shocks due to a central hole, rather it is possibly to minimize bone, using a planar cut for the planar support and two reduced lateral cuts on the two sides of the patella. The exterior contour of the patellar element 6 is the same as the anatomical contour, and any sharp angles besides those in direct contact with the bone of the patella are eliminated by appropriate connection spokes. /8

Plates 10, 11. Figures 25, 26, 27, 28, 29, 30, 31.

Description of prostheses for repeat interventions.

During later interventions or in case of severe trauma (accidents, war injuries...), this prosthesis can be completed, adapted and changed to confront the problem without deep changes in its general design and its performances.

Plate 10. Figures 25, 26, 28.

In the case where only the automatic rotation of the knee cannot be preserved, the femoral element 1 comprises, on its sliding face, a groove having a rectangular cross section, in the plane of symmetry of the prosthesis, going from the posterior notch forming two condyle "tongues" to a point beyond the vertical of the anterior border of the fixation pivot of this element in the femur. This groove has a width which progressively becomes smaller toward the anterior part, and finally the width is constant.

On the slide 3, or, if it is absent, on the intermediary plate 5, a tenon, which has a rectangular cross section, a width identical to that of the fixed anterior part of the femoral element 1, and a length such that in any flexed position (outside of the walking amplitude) the tenon can freely turn in the groove of the femoral element 1, has its longitudinal plane of symmetry oblique with respect to the plane of symmetry of the prosthesis, thus ensuring the automatic rotation of the knee. The center of this tenon is at the center of the common contact part of the contact between femoral element 1-slide 3 when the patient is in the standing position.

Plate 11. Figures 29, 30, 31. /9

In the case where the lateral ligaments and/or the oblique popliteal, semi-membranous ligament cannot be preserved or is(are) destroyed, the femoral element 1 and the tibial element 2 are thicker, the slide 3 is then often eliminated, and artificial ligaments L_1, L_2, L_3, L_4, which are currently available and relatively thin but broad, ending in a enlargement B_1, B_2, B_3, B_4, B_5, B_6, allowing the fixation are installed on the prosthesis.

For the lateral ligaments, bars Ba_1, Ba_2, Ba_3, Ba_4, which are assembled by screws V_1, V_2, V_3, V_4 on both sides of the femoral element 1 and the tibial element 2, tighten the ligament, and the enlargement at each end of the ligaments prevents them from sliding while at the same time allowing their easy replacement.

For the popliteal ligament and the semi-membranous ligaments, the same principle is used, where the points of fixation are in the axis and in the back of the tibial element, and in the hollow of the notch of the femoral element.

In summary, the principal characteristics of this invention can be defined as follows.

Total knee prosthesis comprising a femoral element 1, a tibial element 2, a slide 3 and a patellar element 6, characterized in that the shape of the contact between the femoral part 1 and the rest of the prosthesis is a spiral with variable winding radius and horizontal axis, whose perpendicular cross sections consists of two rectilinear and aligned segments which are separated by an arc of a circle forming a concavity or a convexity with respect to this femoral part, and in that the tibial part 2 receives a shock absorbing material 4 on which the intermediate plate 5, which contains the slide of the slide 3, rests; the intermediate plate forms, together with the /10

tibial element, a baffle ~~seal which prevent~~s the latter from turning with respect to each other, and a cylindrical engagement one into the other to prevent any relative translation of these two elements.

Prosthesis characterized in that the tibial element 2, plate 5 and shock absorbing element 4 have a contour which reproduces that of the contour of the human tibial plate, that is a rectangular base with a width which is reduced by an adapted radius of curvature and notched on the other side in its plane of symmetry, where these different profiles have connection spokes between them so as not to create any sharp angles which can cause injury to the patient.

Prosthesis characterized in that the tibial element 2 consists of a relatively thin plate, which has a rigid contour defined in the preceding paragraph, an edge which in cross section forms a 'stair case' pattern allowing the positioning of the shock absorbing element and ensuring the engagement and the baffle seal of the plate 5, where a pivot enters into the medullary cavity of the tibia to be able to effect the sealing to the tibia, and a blind cylindrical hole of the same axis as the pivot to receive the pivot of the plate 5.

Prosthesis characterized in that the shock absorbing element 4 is perfectly centered in the cavity of the tibial element 2, possesses a hole which allows the passage of the pivot of the plate 5, recesses allowing variation in its shape to allow it to play its shock absorbing role, and a thickness such that it absorbs the shocks of walking and of different human activities without the plate 5 coming in vertical contact with the tibial element 2.

Prosthesis characterized in that the plate 5 consists of a plate which is relatively thin but /11 rigid and has the same contour as the tibial element 2 , and which carries on its lower face an internally centering edge for the shock absorbing element 4, and which forms on the exterior a baffle with the profile of the tibial element 2, where a pivot comes to be centered in the hole of the tibial element 2 in such a manner that sufficient space is left in the bottom to allow the shock absorption of the prosthesis, and where, on its upper face, a vertically unilateral and horizontally bilateral slide with prismatic cross section allows sliding of the slide 3.

Prosthesis characterized in that the slide 3 possesses on its lower face a shape which is complementary to the slide of the plate 5, and shorter than the latter so as not to "overextend" over the front and back profile of this plate during movement, a front and back profile identical to the front and back profiles of the plate 5, and on its upper face a profile having a perpendicular cross section which is complementary to that of the spiral of the femoral element 1 having a winding radius which is identical to the part of the spiral of the femoral element in the standing position for the patient; in the case where the slide 3 is eliminated, it is the plate 5 which carries this contact surface on its upper face instead of the slide.

Prosthesis characterized in that the femoral element 1 possesses a cylindrical frictional shape which is the in the form of a spiral with 3 or 4 centers or a continuous variation of the winding radius to approximate as much as a possible the patient's anatomy and has a perpendicular cross section which is formed from two equal and co-linear segments, which are separated by a convex or concave arc of a circle with constant radius with respect to this femoral element 1; this spiral is continued on the front side by increasing its curvature, using a right or /12 left helicoidal central line, depending on whether the prosthesis is for a right or left knee, to respect the anatomy; in this part the width of the prosthesis decreases until it becomes zero, and the length of the arc of a circle also decreases to receive the patellar element 6, its internal part consists of 5 planes which are perpendicular to the axis of symmetry of the prosthesis to reduce the loss of bone material while preserving a good rigidity for the entire assembly, where a pivot becomes encrusted in the medullar channel of the femur for sealing the latter to the prosthesis and where a notch in the back forms two "curved tongues" to allow the passage of human ligaments and tendons whose preservation is crucial; all these forms are interconnected by connection spokes, except for the internal part where the resected femoral bone and the sealing come in contact so as not to present any sharp angles which could injure the patient.

Prosthesis characterized in that the patellar element 6 possesses on its face in contact with the femoral element 1, a profile and a spiral which is complementary to the profile of the femoral element 1 and, on its internal face (bone side of the patella), a vertical cylindrical profile having a hollow prismatic perpendicular cross section, formed from a central plane and from two male flanks on the sides of this element to prevent the patellas from becoming brittle.

Prosthesis characterized in that, in the case of a second intervention or more, or in the case of an accident or a war injury which has substantially destroyed the joint, the slide 3, or if that is not possible, the plate 5 has a rectangular tenon in the plane of symmetry of the prosthesis, whose center is the vertical or in front of the axis of the femur, when the patient is in standing position and the large axis is inclined with respect to the plane of symmetry of the prosthesis; /13 the femoral element 1 possesses, in its plane of symmetry, on its frictional face, a groove (having the same spiral profile as the frictional surface) which is broader than the tenon to allow the rotation about the axis of the tibia of the knee in the flexed position, this groove progressively decreases in width elsewhere until it has the same width as the tenon in the common area between the tenon and the groove, when the patient is standing to cause the "automatic rotation" of the knee when the patient moves with extension, the femoral element 1 and the tibial element 2 can be thicker to compensate for bone losses.

Prosthesis characterized in that, if the ligaments can not be preserved, one adds three artificial "ligaments" which connect the femoral element 1 and the tibial element 2, on the one

hand, in the back and in the plane of symmetry of the prosthesis and, on the other hand, on the two lateral flanks of the prosthesis; these ligaments are flexible and elastic connections which are similar to conventional artificial ligaments and which are fixed, for example, by retainers and screws to allow for easy replacement on the tibial element and the femoral element, where the ligaments have a enlargement at each end to facilitate this anchoring and prevent sliding motions.

<u>Claims</u> /14

1./Claim No. 1:

Total knee prosthesis comprising a femoral element 1, a tibial element 2, a slide 3 and a patellar element 6, characterized in that the shape of the contact between the femoral part 1 and the rest of the prosthesis is a spiral with variable winding radius and horizontal axis, whose perpendicular cross sections consists of two rectilinear and aligned segments which are separated by an arc of a circle forming a concavity or a convexity with respect to this femoral part, and in that the tibial part 2 receives a shock absorbing material 4 on which the intermediate plate 5, which contains the slide of the slide 3, rests; the intermediate plate forms, together with the tibial element, a baffle seal which prevents the latter from turning with respect to each other, and a cylindrical engagement one into the other to prevent any relative translation of these two elements.

2./Claim No. 2:

Prosthesis according to Claim 1, characterized in that the elements tibial element 2, plate 5 and shock absorbing element 4 have a contour which reproduces that of the contour of the human tibial plate, that is a rectangular base with a width which is reduced by an adapted radius of curvature and notched on the other side in its plane of symmetry, where these different profiles have connection spokes between them so as not to create any sharp angles which can cause injury to the patient.

3./Claim No. 3:

Prosthesis according to Claims 1 and 2, characterized in that the tibial element 2 consists of a relatively thin plate, which has a rigid contour defined in the preceding paragraph, an edge which in cross section forms a 'stair case' pattern allowing the positioning of the shock absorbing element and ensuring the engagement and the baffle seal of the plate 5, where a pivot enters into the medullary cavity of the tibia to be able to effect the sealing to the tibia, and a blind cylindrical hole of the same axis as the pivot to receive the pivot of the plate 5. /15

4./Claim No. 4:

Prosthesis according to any one of the preceding claims, characterized in that the shock absorbing element 4 is perfectly centered in the cavity of the tibial element 2, possesses a hole

which allows the passage of the pivot of the plate 5, recesses allowing variation in its shape to allow it to play its shock absorbing role, and a thickness such that it absorbs the shocks of walking and of the different human activities without the plate 5 coming in vertical contact with the tibial element 2.

5./Claim No. 5:

Prosthesis according to any one of the preceding claims, characterized in that the plate 5 consists of a plate which is relatively thin but rigid and has the same contour as the tibial element 2, and which carries on its lower face an internally centering edge for the shock absorbing element 4, and which forms on the exterior a baffle with the profile of the tibial element 2, where a pivot comes to be centered in the hole of the tibial element 2 in such a manner that sufficient space is left in the bottom to allow the shock absorption of the prosthesis, and where, on its upper face, a vertically unilateral and horizontally bilateral slide with prismatic cross section allows sliding of the slide 3. /16

6./Claim No. 6:

Prosthesis according to Claims 1 and 5, characterized in that the slide 3 possesses on its lower face a shape which is complementary to the slide of the plate 5, and shorter than the latter so as not to "overextend" over the front and back profile of this plate during movement, a front and back profile identical to the front and back profiles of the plate 5, and on its upper face a profile having a perpendicular cross section which is complementary to that of the spiral of the femoral element 1 having a winding radius which is identical to the part of the spiral of the femoral element in the standing position for the patient; in the case where the slide 3 is eliminated, it is the plate 5 which carries this contact surface on its upper face instead of the slide.

7./Claim No. 7:

Prosthesis according to Claims 1 and 8, characterized in that the femoral element 1 possesses a cylindrical frictional shape which is the in the form of a spiral with 3 or 4 centers or a continuous variation of the winding radius to approximate as much as a possible the patient's anatomy and has a perpendicular cross section which is formed from two equal and colinear segments, which are separated by a convex or concave arc of a circle with constant radius with respect to this femoral element 1; this spiral is continued on the front side by increasing its curvature, using a right or left helicoidal central line, depending on whether the prosthesis is for a right or left knee, to respect the anatomy; in this part the width of the prosthesis decreases until it becomes zero, and the length of the arc of a circle also decreases to receive the patellar element 6, its internal part consists of 5 planes which are perpendicular to the axis of symmetry of the prosthesis to reduce the loss of bone material while preserving a good rigidity for the entire assembly, where a pivot becomes encrusted in the medullar channel of the femur for sealing /17

the latter to the prosthesis and where a notch in the back forms two "curved tongues" to allow the passage of human ligaments and tendons whose preservation is crucial; all these forms are interconnected by connection spokes, except for the internal part where the resected femoral bone and the sealing come in contact so as not to present any sharp angles which could injure the patient.

8./Claim No. 8:

Prosthesis according to Claims 1 and 7, characterized in that the patellar element 6 possesses on its face in contact with the femoral element 1, a profile and a spiral which is complementary to the profile of the femoral element 1 and, on its internal face (bone side of the patella), a vertical cylindrical profile having a hollow prismatic perpendicular cross section, formed from a central plane and from two male flanks on the sides of this element to prevent the patellas from becoming brittle.

9./Claim No. 9:

Prosthesis according to any one of the preceding claims, characterized in that, in the case of a second intervention or more, or in the case of an accident or a war injury which has substantially destroyed the joint, the slide 3, or if that is not possible, the plate 5 has a rectangular tenon in the plane of symmetry of the prosthesis, whose center is the vertical or in front of the axis of the femur, when the patient is in standing position and the large axis is inclined with respect to the plane of symmetry of the prosthesis; the femoral element 1 possesses, in its plane of symmetry, on its frictional face, a groove (having the same spiral profile as the frictional surface) which is broader than the tenon to allow the rotation about the axis of the tibia of the knee in the flexed position, this groove progressively decreases in width elsewhere until it has the same width as the tenon in the common area between the tenon and the groove, when the patient is standing to cause the "automatic rotation" of the knee when the patient moves with extension, the femoral element 1 and the tibial element 2 can be thicker to compensate for bone losses.

10./Claim No. 10:

Prosthesis according to Claims 1 and 9, characterized in that, if the ligaments cannot be preserved, one adds three artificial "ligaments" which connect the femoral element 1 and the tibial element 2, on the one hand, in the back and in the plane of symmetry of the prosthesis and, on the other hand, on the two lateral flanks of the prosthesis; these ligaments are flexible and elastic connections which are similar to conventional artificial ligaments and which are fixed, for example, by retainers and screws to allow for easy replacement on the tibial element and the femoral element, where the ligaments have a enlargement at each end to facilitate this anchoring and prevent sliding motions.

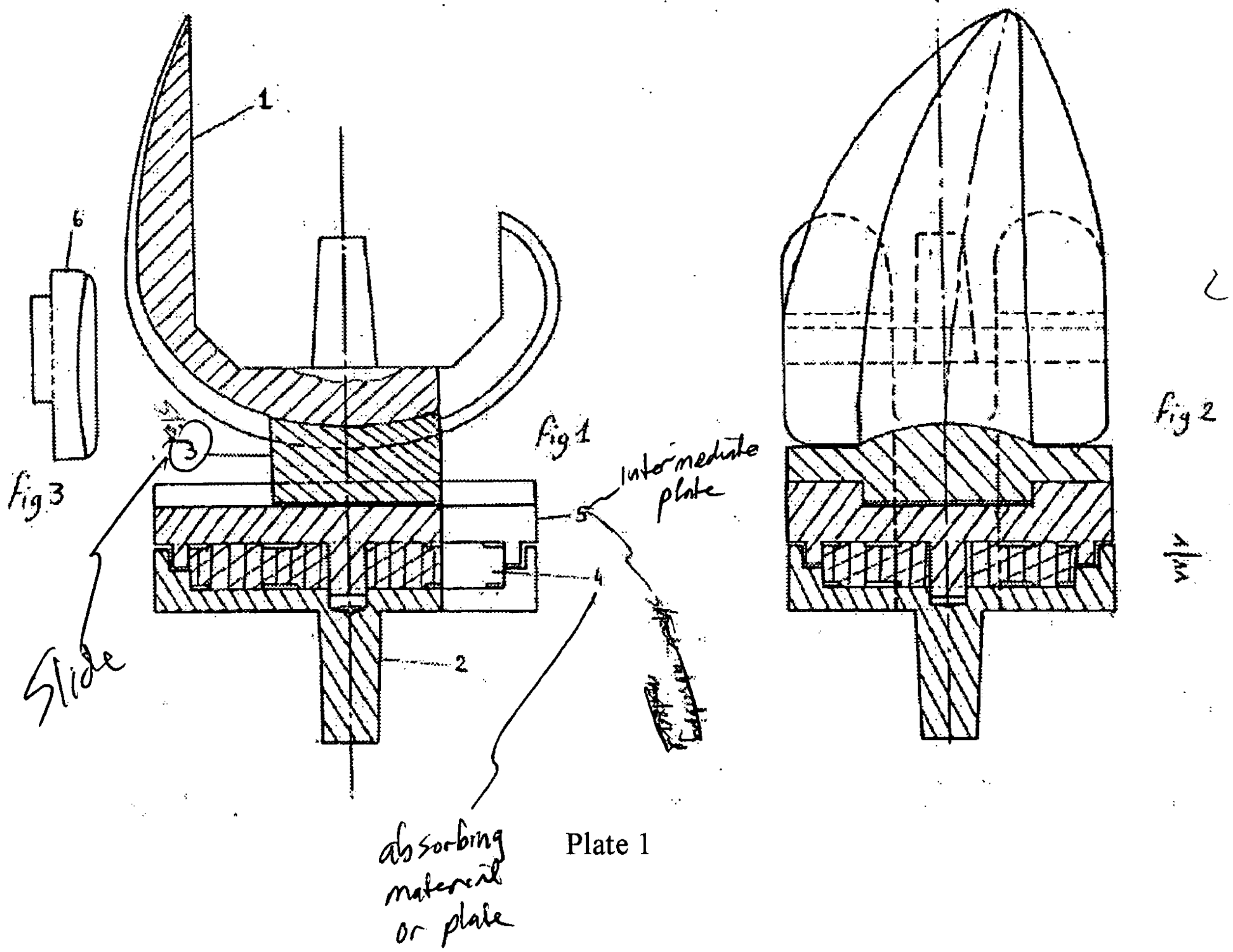
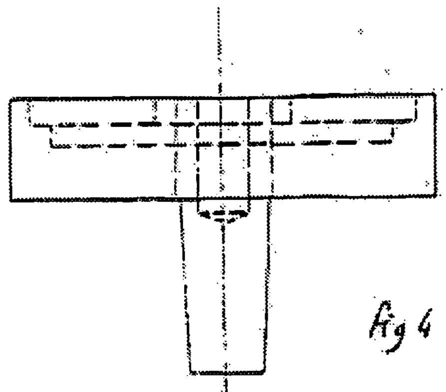

1
6
fig 3
3
Slide
fig 1
intermediate plate
5
4
2
fig 2
absorbing material or plate

Plate 1



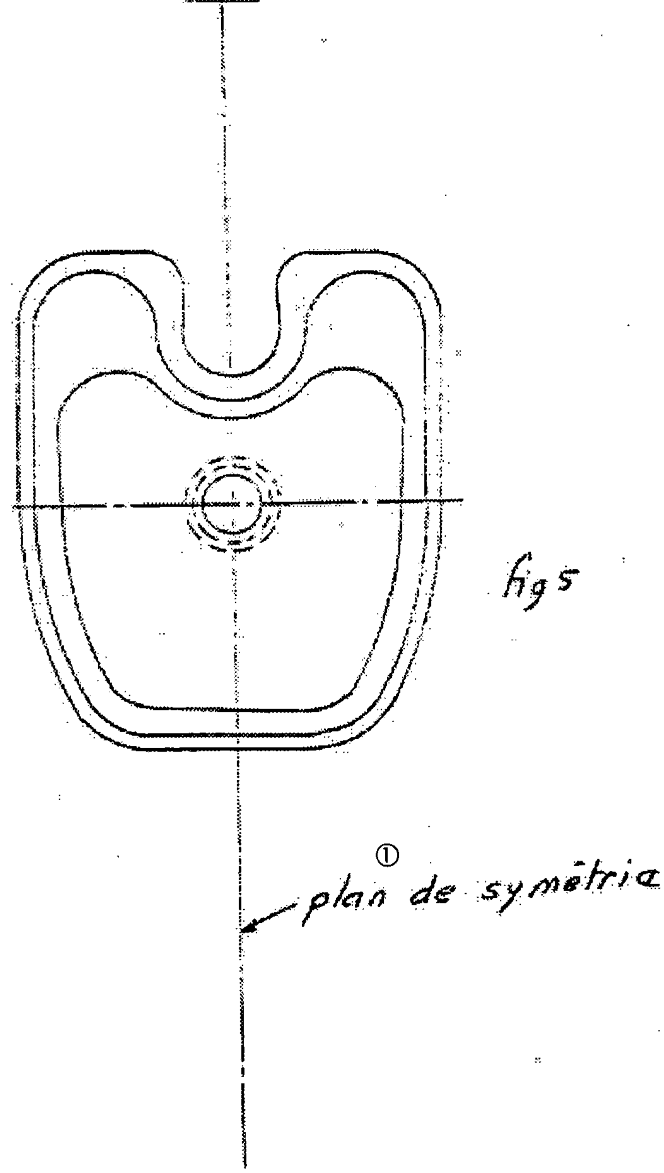


Plate 2

Key: 1 Plane of symmetry

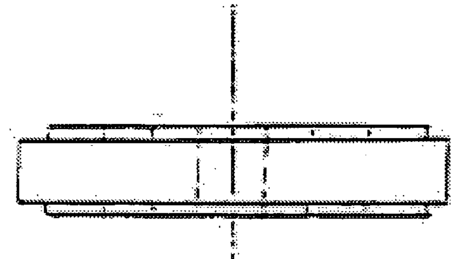


fig. 6

shock absorbing plate 4

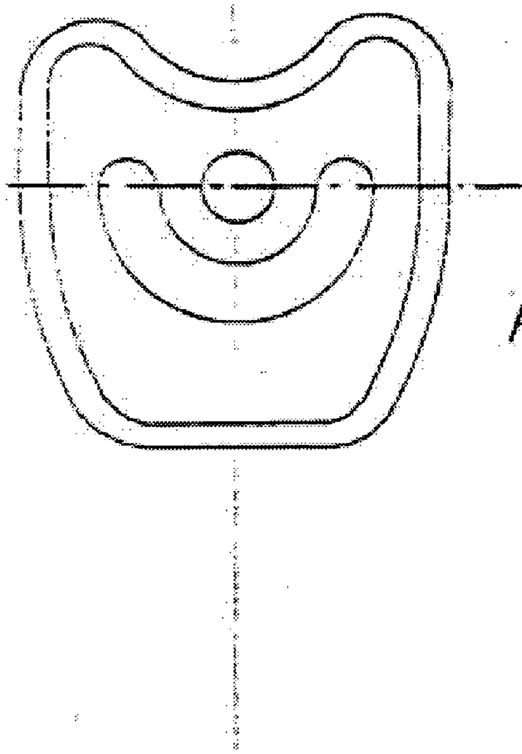


fig. 7

Plate 3

4/M

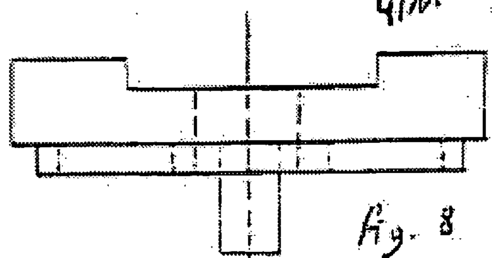


Fig. 8

Intermediate plate 5

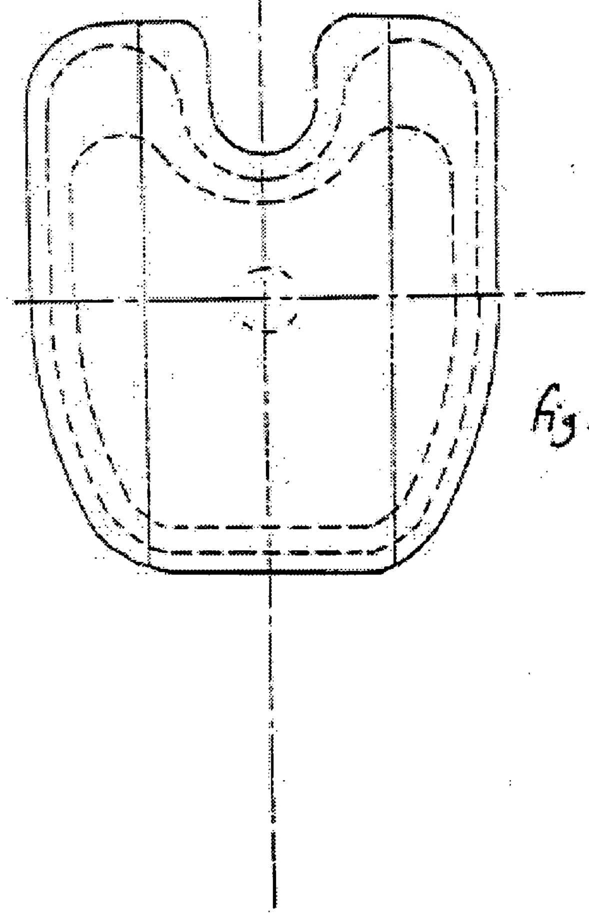


Fig. 9

Plate 4

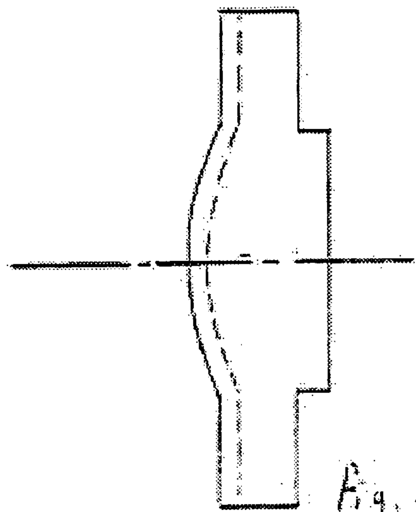


fig. 10

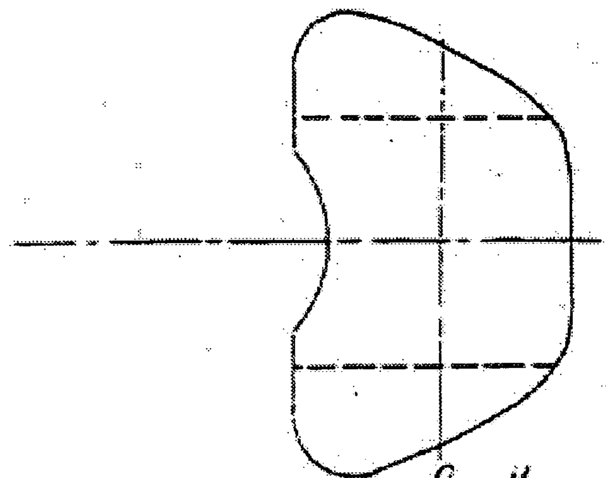


fig. 11

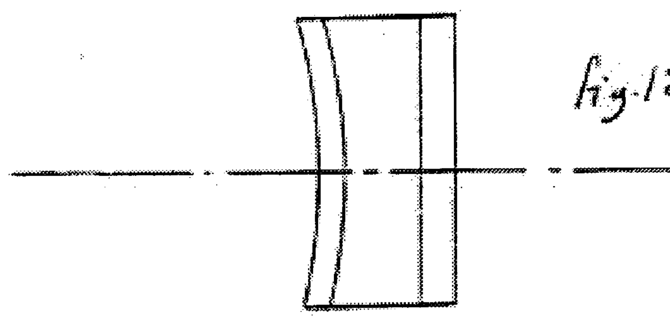


fig. 12

Plate 5

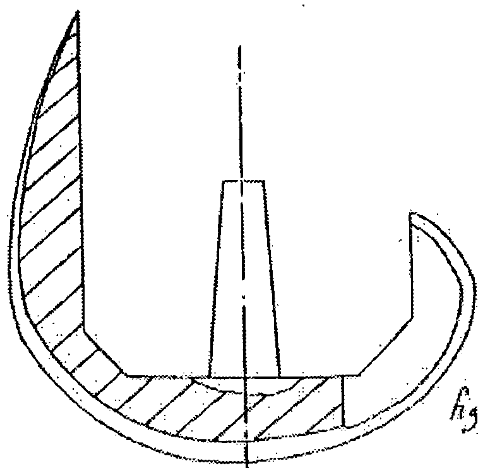


fig. 13

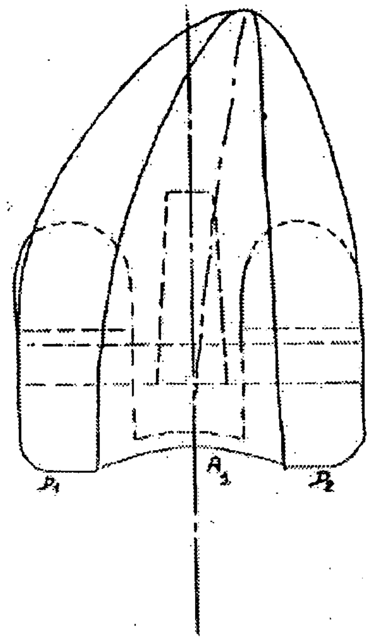


fig. 14

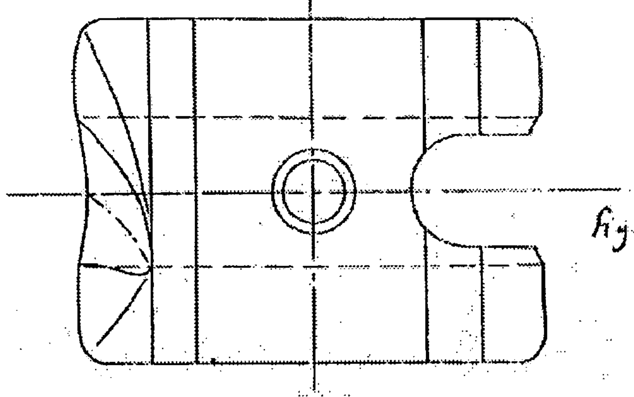


fig. 15

[Plate 6]

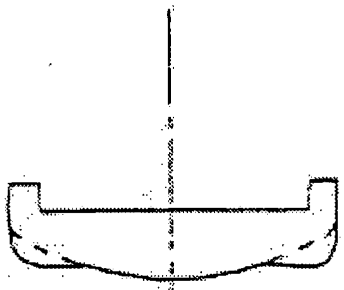


fig.16

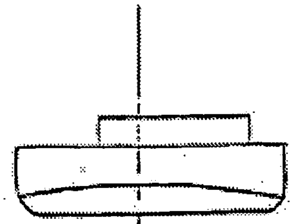


fig.17

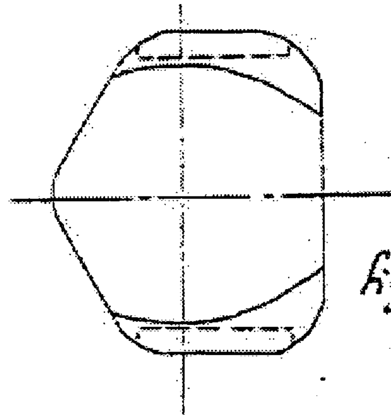


fig.18

Plate 7

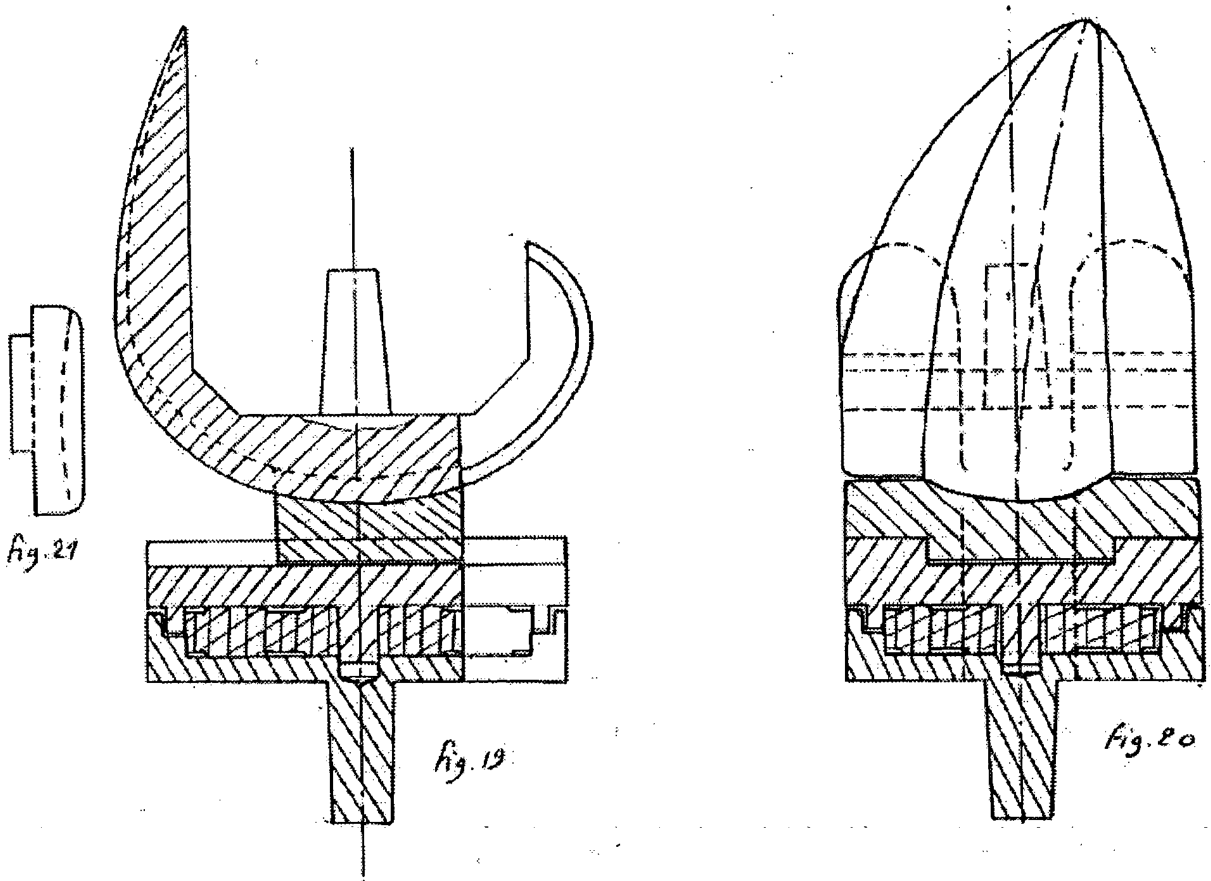


Plate 8

fig.24

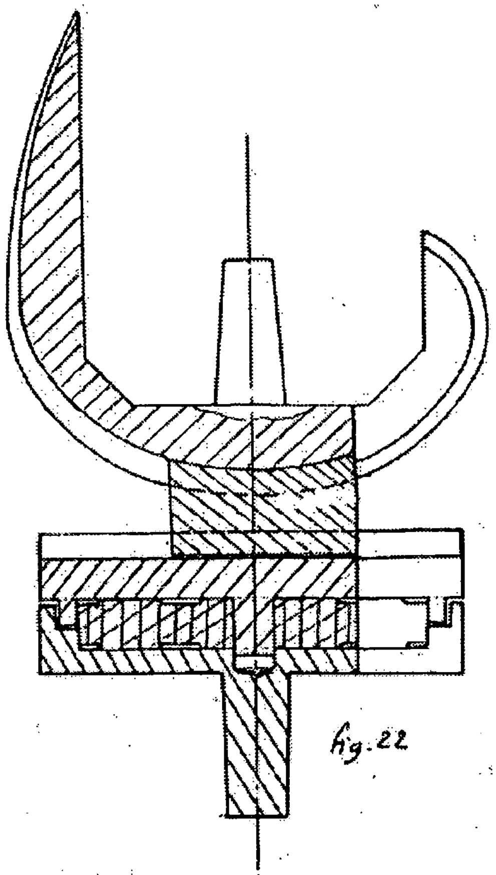


fig.22

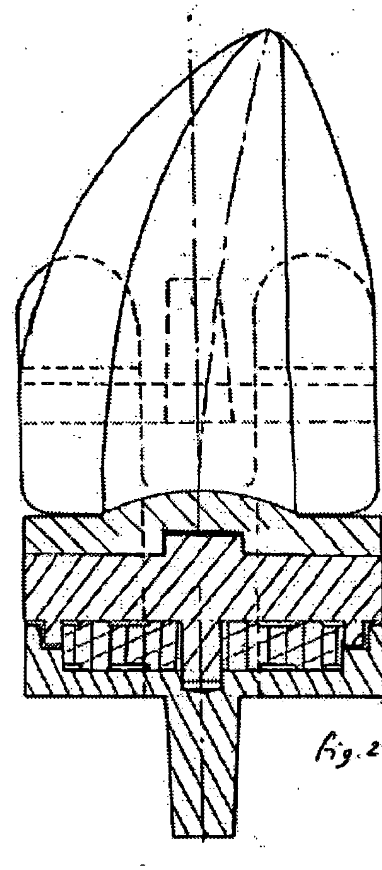


fig.23

Plate 9

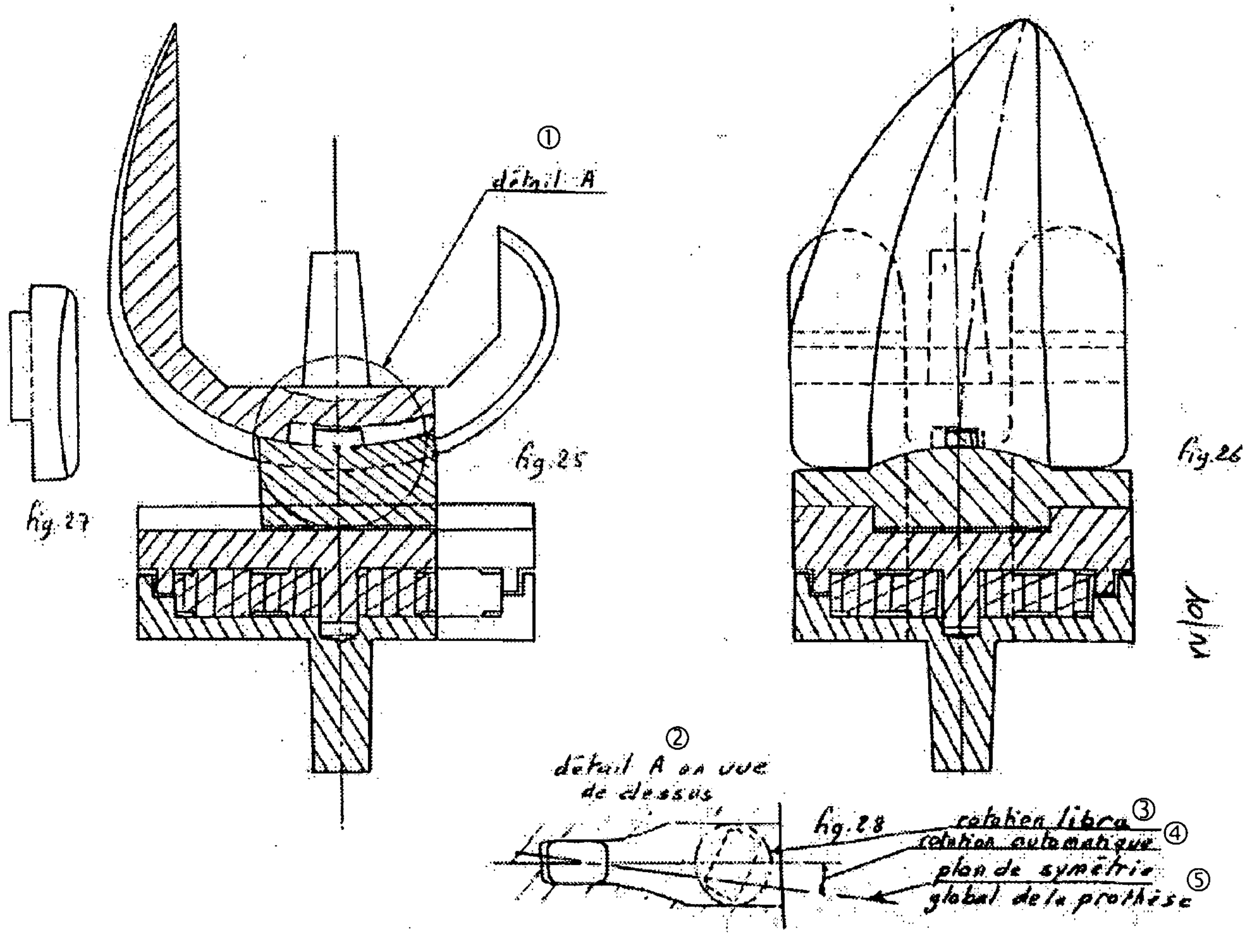


Plate 10

Key:	1	Detail A
	2	Detail A in top view
	3	Free rotation
	4	Automatic rotation
	5	Overall plane of symmetry of the prosthesis

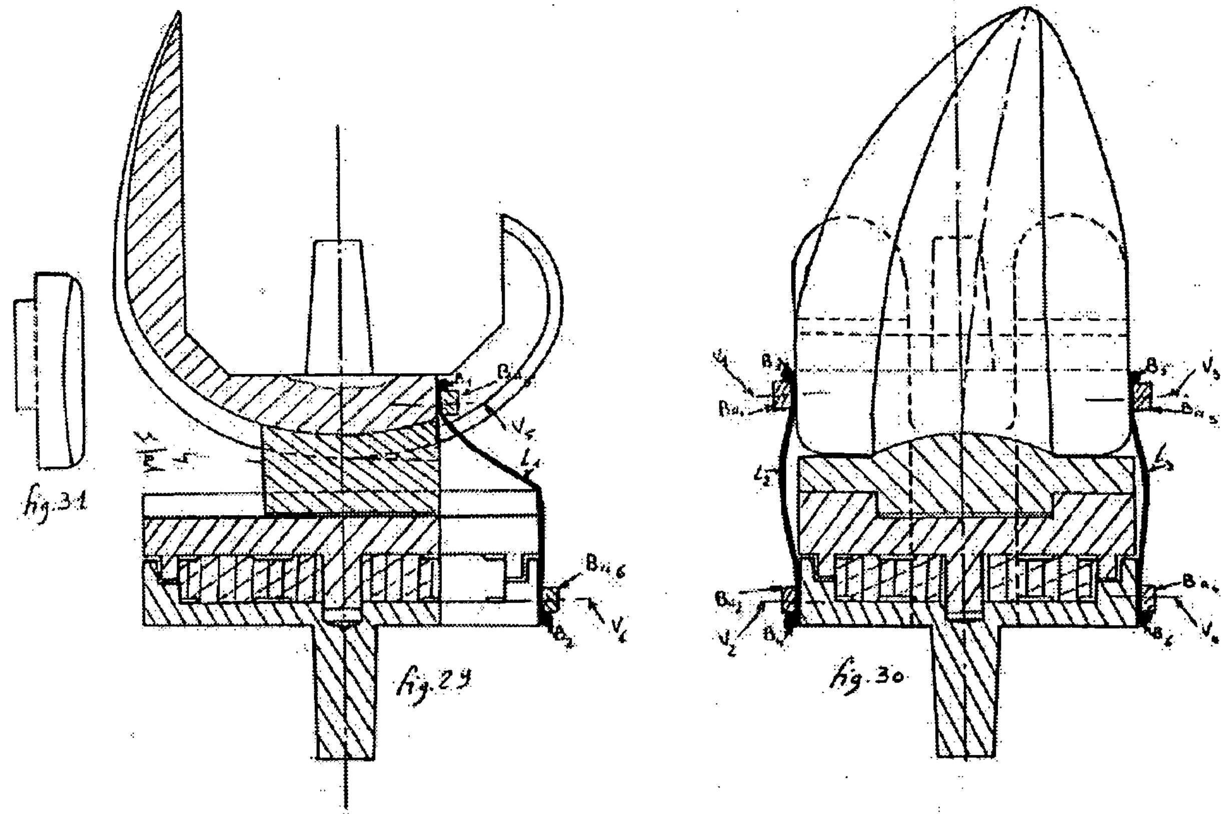


Plate 11

FRENCH REPUBLIC
National Institute
of Industrial Property

Application Number
FA 516701
FR 9506558

PRELIMINARY SEARCH REPORT
established on the basis of the most recent claims filed before the start of the search

DOCUMENTS CONSIDERED TO BE RELEVANT		Claims concerned in the examined document	
Category	Citation of document with indication where appropriate, of relevant passages		
A	EP-A-0 519 873 (BÄHLER) * Abstract; Figure 13A 13B 17 B * ---	1,2,4-6	
A	FR-A-2 710 837 (ETABLISSEMENTS TORNIER) * Abstract; figures * ---	1,2	
A	WO-A-89 06947 (JOINT MEDICAL PRODUCTS CORP) * Page 8, line 3 – line 14; Figures 1-13,18 * ---	1,7,8	
A	EP-A-0 046 926 (WALDEMAR LINK GMBH) * Claim 1; Figures * ---	1	
A	DE-U-91 16 507 (ESKA GMBH) * Claim 1; Figures 3,4 * -----	1	TECHNICAL FIELDS SEARCHED (Int. Cl.6 A61F

Date of completion of the search	Examiner
February 7, 1996	Villeneuve, J-M

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D: Document cited in the application.
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